

Geochemical mapping of 4 Vesta begins

Thomas H Prettyman¹, William C Feldman¹, Olivier Forni², Steven P Joy³, David J Lawrence⁴, Lucille Le Corre⁵, Joseph N Mafi³, Thomas B McCord⁶, Timothy J. McCoy⁷, Harry Y McSween⁸, David W Mittlefehldt⁹, Carol Polanskey¹⁰, Marc Rayman¹⁰, Carol A Raymond¹⁰, Vishnu Reddy⁵, Robert C. Reedy¹, Christopher T Russell³, Timothy N Titus¹¹, Mike J. Toplis²

¹Planetary Science Institute, Tucson, AZ, United States.

²IRAP, University of Toulouse, Toulouse, France.

³University of California Los Angeles, Los Angeles, CA, United States.

⁴Johns Hopkins Applied Physics Laboratory, Laurel, MD, United States.

⁵Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany.

⁶Bear Fight Institute, Winthrop, WA, United States.

⁷Smithsonian Institution, Washington, DC, United States.

⁸University of Tennessee, Knoxville, TN, United States.

⁹NASA Johnson Space Center, Houston, TX, United States.

¹⁰JPL, California Institute of Technology, Pasadena, CA, United States.

¹¹U.S. Geological Survey, Flagstaff, AZ, United States.

By December, the NASA Dawn spacecraft will have descended to a low altitude mapping orbit (LAMO), where the Gamma Ray and Neutron Detector (GRaND) will acquire global mapping data for up to four months. Measurements by GRaND will help answer elusive questions about how Vesta differentiated and the nature of processes that shaped Vesta's surface. The data will be analyzed to determine the abundances of Mg, Si, Fe, K, Th, and H at a spatial resolution of roughly 300 km full-width-at-half-maximum from a 465 km radius orbit. Thermal and fast neutron counting data will be analyzed to determine the neutron macroscopic absorption cross section and average atomic mass, providing constraints on additional elements, such as Ca and Al. GRaND will quantify the elemental composition of coarse spatial units identified by Dawn's Framing Camera (FC) and the Visible & Infrared Spectrometer (VIR). In addition, GRaND will map the mixing ratio of compositional end members selected from the howardite, eucrite and diogenite (HED) meteorites, determine the relative proportions of plagioclase and mafic minerals, and search for compositions that are absent or under-represented in the meteorite collection. While it is generally thought that Vesta's crust on a regional scale should be well-represented by linear mixing of HED whole-rock compositions, there are hints that Vesta may be more diverse than implied by this model. For example, the discovery of K-rich impact glasses in howardites suggests that K-rich rocks may be present on a portion of Vesta's surface, and the analysis of diogenites indicates considerable variability in the magmatic processes that formed them. The chemical composition of materials within Vesta's south polar structure may provide further clues to how it formed. An impact might have exposed mantle and lower crustal materials, which should have a distinctive compositional signature. We present the analysis of data acquired by GRaND from cruise through the descent to LAMO, including GRaND's sensitivity to different elements and geochemical processes.